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EXPERIMENTAL MEASUREMENTS OF THE VOLUMETRIC AND PHASE BEHAVIOR OF MIXTURES OF NITRIC OXIDE AND NITROGEN DIOXIDE

Supplementary to

VOLUMETRIC AND PHASE BEHAVIOR OF MIXTURES OF NITRIC OXIDE AND NITROGEN DIOXIDE

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Chemical Engineering Laboratory
California Institute of Technology

November, 1952

EXPERIMENTAL MEASUREMENTS OF THE VOLUMETRIC AND PHASE BEHAVIOR OF MIXTURES OF NITRIC OXIDE AND NITROGEN DIOXIDE

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Experimental measurements were made of the volumetric behavior of [illegible] mixtures of nitric oxide and nitrogen dioxide for pressures up to 7,000 pounds per square inch in the temperature interval between 40° and 340° F. [illegible] of these compositions were investigated in detail and the remainder [illegible] studied at only one specific volume. These measurements were made [illegible] constant volume equipment (1, 2) by following the change in pressure with temperature at a constant weight of sample. The total quantity of mixture in the isochoric equipment was varied in the case of four mixtures by withdrawing portions of the sample at a homogeneous state and determining the change in weight of sample by weighing bomb techniques. Dew points and bubble points were established by discontinuities in the isochoric pressure-temperature derivatives.

The total volume of the spherical isochoric vessel used in these measurements was determined as a function of temperature and pressure from a knowledge of the volume at one state and the thermal expansion and Young's modulus of the steel employed in its construction. The spherical form of the vessel together with a nearly uniform wall thickness permitted such strain calculations to be made with accuracy. The volumetric characteristics

of the vessel were checked by calibration with water using the data of Smith and Keyes (3) for the volumetric behavior of the latter compound at elevated temperatures and pressures. Agreement with the calculated total volume of the sphere within 0.1% was obtained at temperatures between 40° and 340° F. and for pressures up to 7,000 pounds per square inch. In the course of the present work the volumetric characteristics based upon the properties of the steel were employed to determine the effect of temperature and pressure upon the total volume of the sphere.

Table I records corresponding values of pressure, temperature, and specific volume for each of the four mixtures which were investigated systematically. For each of these mixtures the pressure-temperature relations were determined for a number of different weights of sample. Table II records corresponding values of pressure, temperature, and specific volume for the 11 other mixtures investigated. In each of these cases only a single weight of sample was studied. The absence of a series of measurements at different weights of sample (different specific volumes) for a mixture of fixed composition results in difficult direct interpolation of the data to even values of pressure, temperature, and composition.

The pressures recorded in Tables I and II involve a standard error of 0.1% of the value or 0.3 pound per square inch, whichever is the larger measure of uncertainty. The weight of sample employed was known within 0.03% and the standard error in predicting the total volume of the

working vessel was 0.1%. It is believed that the specific volumes were established with a standard error of 0.15%. The temperature of the vessel was determined with a platinum resistance thermometer with a standard error of 0.03° F. from the international platinum scale. The estimates of small standard error were confirmed by the precision of the measurements which was about one-half of the total of the standard error of the several variables involved.

The results of the experimental measurements of the bubble point and dew point states are recorded in Table III for four mixtures which were investigated systematically and 11 mixtures which were studied at a single total weight of sample. These data were established from discontinuities in the nearly isochoric pressure-temperature derivative obtained from the data presented in Table I. The uncertainty in determining the bubble point and dew point states depends upon proximity to the critical state of the mixture. In the immediate vicinity of the critical state the change in slope of the isochoric pressure-temperature relation at the phase boundary is small. For this reason the uncertainty in the location is several times the standard error realized in determining experimentally the corresponding values of pressure and temperature. At a distance from the critical state the uncertainty in establishing the phase boundary is not more than twice the standard error of measurement.

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2. Reamer, H. H., and Sage, B. H., Ind. Eng. Chem., 44, 185 (1952).

3. Smith, L. B., and Keyes, F. G., Proc. Am. Acad. Arts and Sci., 69, 285 (1934).

TABLES

TABLE I

SPECIFIC VOLUME OF FOUR MIXTURES OF NITRIC OXIDE AND NITROGEN DIOXIDE

Weight Fraction Nitrogen Dioxide = 0.94305

Sample Weight = 0.792956 lb.

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.
24.19	40.07	0.011008
25.55	42.05	0.011009
25.68	43.98	0.011009
26.03	45.99	0.011010
26.72	47.98	0.011010
82.72	50.04	0.011011
209.81	51.00	0.011011
335.21	52.05	0.011012
1326.22	60.00	0.011015
2576.81	70.01	0.011020
3824.14	80.05	0.011024
5044.04	90.01	0.011028
6263.92	100.02	0.011032

Sample Weight = 0.782572 lb.

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.
31.17	55.00	0.011158
31.73	55.00	0.011158
34.82	59.99	0.011160
32.25	60.01	0.011160
36.63	64.00	0.011161
37.08	64.00	0.011161
149.18	66.00	0.011162
633.56	70.01	0.011163
1834.21	80.00	0.011167
1845.75	80.23	0.011167
3023.12	90.00	0.011172
4206.07	100.00	0.011176
5379.52	110.01	0.011180
7144.18	125.00	0.011187

Sample Weight = 0.744286 lb.

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.
71.73	110.01	0.011748
77.95	115.02	0.011749
81.45	117.99	0.011750
81.68	118.01	0.011750
166.33	119.03	0.011751
265.31	120.00	0.011751
1284.26	130.01	0.011755
2305.54	140.01	0.011760
3320.02	150.00	0.011764
4336.61	160.00	0.011768
5358.91	170.02	0.011772
6909.73	185.00	0.011779

TABLE I (cont.)

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.
Weight Fraction Nitrogen Dioxide = 0.94305		
Sample Weight = 0.692236 lb.		
203.44	170.01	0.012650
220.73	175.00	0.012651
232.08	178.01	0.012652
235.00	179.01	0.012652
371.27	181.01	0.012653
459.17	182.02	0.012654
1133.93	190.02	0.012657
1990.65	200.01	0.012661
2852.29	210.00	0.012666
2852.38	210.00	0.012666
4164.37	224.99	0.012672
5517.45	240.00	0.012679
6536.41	251.02	0.012684
6910.41	255.05	0.012685
Sample Weight = 0.617948 lb.		
126.08	140.02	0.014160
170.52	160.01	0.014167
325.80	200.01	0.014181
559.69	235.00	0.014193
602.62	240.00	0.014195
620.12	242.01	0.014195
677.80	243.00	0.014196
762.75	244.00	0.014196
1152.68	250.00	0.014199
2200.13	265.02	0.014206
3293.27	280.02	0.014213
3293.46	280.01	0.014213
4434.74	295.03	0.014220
5612.05	310.02	0.014227
6841.76	325.03	0.014234
Sample Weight = 0.549798 lb.		
47.65	80.00	0.015892
62.52	100.01	0.015898
145.69	150.00	0.015919
384.94	210.07	0.015942
701.60	250.00	0.015958
932.13	270.02	0.015966
997.38	275.04	0.015968
1144.55	280.01	0.015970
1252.95	282.01	0.015971
1698.59	290.02	0.015975
1698.85	290.02	0.015975
2869.61	310.01	0.015985
3802.52	325.01	0.015993
4778.50	340.02	0.016000
4782.89	340.00	0.016000

TABLE I (cont.)

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.	Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.

Weight Fraction Nitrogen Dioxide = 0.94305

Sample Weight = 0.460197 lb.			Sample Weight = 0.207086 lb.		
445.03	220.05	0.019051	679.70	249.98	0.042368
991.98	275.02	0.019077	1163.80	289.99	0.042410
1136.97	285.04	0.019082	1432.66	304.99	0.042427
1218.97	290.04	0.019085	1529.01	309.99	0.042433
1305.01	295.03	0.019087	1589.28	313.90	0.042437
1397.10	300.04	0.019090	1658.07	318.02	0.042442
1518.41	305.04	0.019092	1720.58	321.99	0.042446
1715.51	310.04	0.019095	1782.88	326.00	0.042450
2124.27	320.04	0.019100	1846.07	329.97	0.042454
2554.30	330.06	0.019106	2008.29	339.99	0.042465
2994.89	340.28	0.019111	2024.19	340.02	0.042465

Sample Weight = 0.356587 lb.		
451.51	220.00	0.024586
691.55	250.01	0.024605
1048.46	280.00	0.024623
1380.19	300.01	0.024636
1577.78	310.03	0.024643
1692.83	315.01	0.024646
1806.96	319.26	0.024649
2104.77	330.00	0.024656
2404.30	340.00	0.024663
2412.77	340.03	0.024663

TABLE I (cont.)

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.	Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.
Weight Fraction Nitrogen Dioxide = 0.82046					
Sample Weight = 0.745091 lb.			Sample Weight = 0.698354 lb.		
31.94	60.00	0.011721	178.43	140.01	0.012530
73.65	95.00	0.011731	215.59	150.01	0.012533
81.16	100.00	0.011732	257.90	159.99	0.012536
545.65	105.00	0.011734	403.12	162.03	0.012537
1093.55	110.00	0.011737	683.63	165.00	0.012538
2209.09	120.00	0.011741	1157.93	170.00	0.012540
3327.09	130.00	0.011745	1628.69	175.00	0.012542
4436.51	140.00	0.011750	3076.80	189.99	0.012549
4438.04	140.01	0.011750	4537.82	205.01	0.012556
5543.97	150.00	0.011754	6035.13	220.00	0.012562
6665.61	159.99	0.011758	7042.21	229.99	0.012567
Sample Weight = 0.723010 lb.					
97.61	110.00	0.012094			
119.76	120.00	0.012097			
150.85	130.00	0.012100			
300.17	131.99	0.012100			
593.88	135.00	0.012100			
1106.22	140.00	0.012104			
2155.47	150.01	0.012108			
3194.69	160.00	0.012113			
4748.85	175.00	0.012119			
6329.88	189.99	0.012126			

TABLE I (cont.)

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.

Weight Fraction Nitrogen Dioxide = 0.82046

Sample Weight = 0.667990 lb.

308.23	170.02	0.013109
363.08	180.00	0.013112
427.98	190.00	0.013115
639.83	195.00	0.013117
1071.71	200.00	0.013119
1507.85	205.01	0.013122
2827.12	219.76	0.013128
4202.02	234.98	0.013135
5608.78	250.00	0.013142
6559.05	260.01	0.013147

Sample Weight = 0.551141 lb.

50.69	80.00	0.015953
322.08	235.01	0.015914
1013.69	250.01	0.015920
1163.03	260.01	0.015924
1241.32	265.01	0.015926
1242.55	265.00	0.015926
1337.46	270.01	0.015928
1390.30	271.76	0.015929
1602.26	275.24	0.015930
1895.22	280.00	0.015933
2866.55	295.01	0.015940
3881.29	310.01	0.015948
4942.01	325.01	0.015956
6044.10	340.00	0.015964

Sample Weight = 0.632528 lb.

488.88	200.00	0.013854
571.05	210.01	0.013858
664.76	220.00	0.013861
813.62	225.03	0.013863
1228.21	230.23	0.013865
1596.61	234.99	0.013867
2821.09	250.01	0.013874
4093.08	265.00	0.013882
5394.79	280.00	0.013889
6739.01	295.00	0.013896

TABLE I (cont.)

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.	Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.

Weight Fraction Nitrogen Dioxide = 0.94059

Sample Weight = 0.198594 lb.

45.08	100.00	0.043989
150.68	159.99	0.044052
417.11	220.00	0.044117
1013.59	280.00	0.044183
1204.48	292.55	0.044217
1333.23	300.00	0.044229
1427.00	305.01	0.044206
1521.00	310.00	0.044212
1673.96	320.03	0.044197
1977.93	340.00	0.044251

Sample Weight = 0.0863081 lb.

396.79	220.00	0.10151
624.80	250.01	0.10159
776.64	264.99	0.10163
833.26	270.00	0.10164
924.14	280.00	0.10166
1041.70	299.99	0.10171
1159.31	320.00	0.10176
1274.68	340.01	0.10181
1276.15	340.00	0.10181

Sample Weight = 0.038907 lb.

195.47	180.00	0.22497
374.70	220.00	0.22519
405.69	225.00	0.22534
447.20	235.00	0.22527
482.79	250.00	0.22534
556.17	280.00	0.22551
628.03	310.00	0.22568
697.00	340.00	0.22568
697.63	340.00	0.22584

Sample Weight = 0.013429 lb.

41.03	100.00	0.65052
105.97	150.00	0.65241
127.06	160.00	0.65146
138.89	165.00	0.65154
145.31	170.00	0.65162
153.71	180.00	0.65178
185.16	220.00	0.65241
231.17	280.00	0.65334
271.87	340.00	0.65428

TABLE I (cont.)

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.
Weight Fraction Nitrogen Dioxide = 0.83125		
Sample Weight = 0.244125 lb.		
75.84	100.01	0.035784
232.86	160.00	0.035837
593.92	220.00	0.035890
1330.30	279.99	0.035944
1510.82	290.00	0.035953
1607.99	295.00	0.035958
1710.38	300.00	0.035963
1817.92	305.00	0.035968
1924.51	310.00	0.035972
2027.42	315.00	0.035977
2126.22	320.00	0.035982
2535.54	340.00	0.036001
Sample Weight = 0.109642 lb.		
804.11	249.97	0.079920
916.39	259.99	0.079990
1041.58	269.99	0.080010
1182.32	280.00	0.080031
1275.25	290.00	0.080050
1432.98	310.00	0.080090
1668.50	340.01	0.080150
Sample Weight = 0.055316 lb.		
416.64	210.00	0.15835
550.47	229.99	0.15843
630.17	240.01	0.15847
692.08	250.00	0.15851
800.22	280.00	0.15862
906.83	310.00	0.15874
1012.37	340.00	0.15885
Sample Weight = 0.024337 lb.		
169.88	160.00	0.35888
231.25	180.00	0.35906
269.16	190.00	0.35915
302.96	200.00	0.35923
331.45	219.76	0.35941
376.31	250.01	0.35967
463.48	310.00	0.36018
500.35	340.00	0.36044
Sample Weight = 0.006350 lb.		
39.27	88.40	1.3753
47.16	99.98	1.3757
56.37	110.00	1.3760
67.70	120.00	1.3764
72.58	130.00	1.3770
76.20	140.00	1.3770
83.26	160.00	1.3777
106.55	220.00	1.3797
124.86	280.00	1.3816
141.74	340.00	1.3836

TABLE II

PRESSURES AND TEMPERATURES FOR MIXTURES OF NITRIC OXIDE AND NITROGEN DIOXIDE AT NEARLY FIXED SPECIFIC VOLUME

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft. / Lb.	Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft. / Lb.
Nitrogen Dioxide					
Weight Fraction = 0.88527			Weight Fraction = 0.88336		
Sample Weight = 0.034383 lb.			Sample Weight = 0.45662 lb.		
52.42	100.00	0.25668	26.65	70.00	0.19268
52.49	100.00	0.25668	52.31	100.00	0.19283
159.11	160.00	0.25709	63.20	100.00	0.19283
349.96	210.00	0.25742	96.06	130.00	0.19299
397.53	220.00	0.25748	164.10	160.00	0.19313
424.72	230.00	0.25756	267.46	190.00	0.19328
469.04	250.00	0.25769	421.31	220.00	0.19344
534.50	280.00	0.25790	486.01	230.00	0.19348
598.84	310.00	0.25809	542.89	240.00	0.19354
			575.67	250.00	0.19359
			665.16	280.00	0.19374
			755.48	310.00	0.19389
			841.05	340.00	0.19404
			843.15	340.00	0.19404
			920.68	370.00	0.19419
			991.88	400.00	0.19434
Nitrogen Dioxide					
Weight Fraction = 0.88114			Weight Fraction = 0.79131		
Sample Weight = 0.023025 lb.			Sample Weight = 0.028264 lb.		
12.86	40.00	0.38182	19.20	40.00	0.34281
50.45	100.00	0.38241	69.60	100.00	0.34335
50.79	100.00	0.38243	70.38	100.00	0.34335
151.17	160.00	0.38301	188.85	160.00	0.34389
245.55	190.00	0.38331	253.75	180.00	0.34407
273.13	260.00	0.38341	292.80	190.00	0.34416
287.82	210.00	0.38351	329.05	200.00	0.34424
301.74	220.00	0.38361	361.92	220.00	0.34443
344.25	250.00	0.38391	408.85	250.00	0.34470
386.54	280.00	0.38421	455.79	280.00	0.34496

TABLE II (cont.)

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.	Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft./Lb.
Nitrogen Dioxide					
Weight Fraction = 0.78280			**Weight Fraction = 0.61770**		
Sample Weight = 0.043282 lb.			**Sample Weight = 0.032786 lb.**		
22.31	40.00	0.22662	51.13	40.00	0.26814
24.22	40.00	0.22662	52.74	40.00	0.26814
79.35	100.00	0.22698	135.40	100.00	0.26856
79.57	100.00	0.22698	136.00	100.00	0.26856
81.14	100.00	0.22698	293.84	160.00	0.26898
213.96	160.00	0.22733	373.18	180.00	0.26912
432.01	210.00	0.22763	419.73	190.00	0.26920
489.94	220.00	0.22769	471.21	200.00	0.26927
524.86	230.00	0.22775	504.08	210.00	0.26934
574.95	250.00	0.22787	525.00	220.00	0.26941
648.80	280.00	0.22805	585.59	250.00	0.26962
721.43	310.00	0.22822	644.84	280.00	0.26983
Nitrogen Dioxide					
Weight Fraction = 0.39620			**Weight Fraction = 0.27157**		
Sample Weight = 0.051115 lb.			**Sample Weight = 0.074574 lb.**		
368.11	40.00	0.17199	820.75	40.00	0.11789
368.97	40.00	0.17199	925.58	100.00	0.11801
380.50	40.00	0.17199	953.33	100.00	0.11805
447.36	100.00	0.17226	1025.92	130.00	0.11817
450.27	100.00	0.17226	1134.58	160.00	0.11827
519.39	130.00	0.17240	1285.21	190.00	0.11833
519.98	130.00	0.17240	1344.31	200.00	0.11836
623.91	160.00	0.17253	1351.47	200.00	0.11839
717.69	180.00	0.17262	1379.79	200.00	0.11841
772.98	190.00	0.17267	1421.24	210.00	0.11842
834.76	200.00	0.17271	1479.73	220.00	0.11846
903.02	210.00	0.17276	1616.90	250.00	0.11853
942.41	220.00	0.17281	1662.22	260.00	0.11858
1038.27	250.00	0.17294	1752.62	280.00	0.11866
1132.57	280.00	0.17308			

TABLE II (cont.)

Pressure, Lb./Sq. In. Absolute	Temperature °F.	Specific Volume, Cu. Ft. / Lb.
Nitrogen Dioxide		
Weight Fraction = 0.94508		
Sample Weight = 0.094347 lb.		
21.45	73.71	0.357897
39.62	100.00	0.358095
73.81	130.00	0.358386
130.05	160.00	0.358680
219.32	190.00	0.358975
257.67	200.00	0.359074
271.85	205.00	0.359124
287.08	215.00	0.359221
294.09	220.00	0.359270
339.72	250.00	0.359562
385.26	280.00	0.359855
429.58	310.00	0.360147
470.37	340.00	0.360440
Nitrogen Dioxide		
Weight Fraction = 0.79994		
Sample Weight = 0.668664 lb.		
17.58	40.00	0.013055
40.65	70.00	0.013064
84.37	100.00	0.013073
104.79	110.00	0.013077
138.39	130.00	0.013085
231.85	150.00	0.013089
274.13	160.00	0.013093
386.01	180.00	0.013099
421.00	184.99	0.013101
465.14	190.00	0.013102
639.40	191.98	0.013103
907.53	195.00	0.013104
1348.04	199.99	0.013107
1796.61	208.00	0.013109
3159.33	220.00	0.013100
5022.68	240.00	0.013100
6951.17	259.99	0.013100
Nitrogen Dioxide		
Weight Fraction = 0.93755		
Sample Weight = 0.939622 lb.		
37.16	100.00	0.942166
68.21	130.00	0.942933
83.13	140.00	0.943189
96.63	150.00	0.943446
101.71	160.00	0.943700
117.99	190.00	0.944464
135.19	220.00	0.945229
152.47	250.00	0.945993
168.29	280.00	0.946757
182.20	310.00	0.947521
194.66	340.00	0.948284

TABLE III

EXPERIMENTAL DEW POINT AND BUBBLE POINT STATES

Pressure, Lb./Sq. Inch. Absolute	Temperature °F.	Specific Volume, Cu. Ft. / Lb.	Pressure, Lb./Sq. Inch Absolute	Temperature °F.
		-BUBBLE POINT		
Weight Fraction Nitrogen Dioxide = 0.94305				
29	49.3	0.011011	50	85.2
38	65.2	0.011161	100	129.6
82	118.0	0.011750	150	152.1
235	179.2	0.012653	200	169.3
623	242.0	0.014195	250	182.9
1029	277.7	0.015970	300	194.9
1466	303.6	0.019091	400	213.6
1611	311.6	0.024644	500	227.9
1540	310.5	0.042433	600	239.7
			800	259.2
			1000	275.6
Weight Fraction Nitrogen Dioxide = 0.82046				
81	100.3	0.011732	50	74.1[a]
153	130.5	0.012100	100	110.3
258	160.1	0.012536	150	129.7
445	192.1	0.013116	200	145.2
696	223.1	0.013862	250	157.9
1334	270.4	0.015928	300	168.7
			400	185.8
			500	199.9
			600	212.6
			800	232.8
			1000	248.1
			1250	265.1
Weight Fraction Nitrogen Dioxide = 0.79994				
439	190	0.013102		

TABLE III (cont.)

DEW POINT

Pressure, Lb. / Sq. Inch Absolute	Temperature °F.	Specific Volume, Cu. Ft. / Lb.	Pressure, Lb. /Sq. Inch Absolute	Temperature °F.
Weight Fraction Nitrogen Dioxide = 0.94059				
143	166.6	0.65157	50	116.4[a]
433	229.6	0.22524	100	146.9[a]
896	275.1	0.10165	130	169.0
1498	308.4	0.044215	200	185.5
			250	196.9
			300	208.0
			400	224.9
			500	239.0
			600	250.3
			800	268.0
			1000	282.4
			1250	296.9
			1500	308.6
Weight Fraction Nitrogen Dioxide 0.83125				
69	121.3	1.3764	50	105.3[a]
299	197.7	0.35921	100	139.9
677	246.1	0.13849	150	160.4
1221	283.0	0.080037	200	175.0
1984	312.9	0.035975	250	187.0
			300	197.9
			400	215.3
			500	228.9
			600	239 2
			800	256.1
			1000	269.9
			1250	284.4

TABLE III (cont.)

DEW POINT

Weight Fraction Nitrogen Dioxide	Pressure, Lb. / Sq. Inch Absolute	Temperature °F.	Specific Volume, Cu. Ft. / Lb.
0.88527	405	221	0.25750
0.88336	531	236	0.19352
0.88133	263	193	0.38334
0.79131	325	197	0.31232
0.78280	508	223	0.20409
0.61770	491	204	0.26929
0.39620	918	214	0.17278
0.27157	1470	219	0.1185
0.94508	268	202	0.33910
0.93755	94	147	0.94340

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